

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Michel POMPEI

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For: A DOUBLE-WALLED ACOUSTIC PANEL

**DECLARATION**

I, Andrew Scott Marland, of 11, rue de Florence, 75008 Paris, France, declare that I am well acquainted with the English and French languages and that the attached translation of the French language PCT international application, Serial No. **PCT/FR2003/003513** is a true and faithful translation of that document as filed.

All statements made herein are to my own knowledge true, and all statements made on information and belief are believed to be true; and further, these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any document or any registration resulting therefrom.

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A DOUBLE-WALLED ACOUSTIC PANEL

The present invention relates to a double-walled acoustic panel having a sound absorber disposed between the walls.

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## BACKGROUND OF THE INVENTION

In such a panel, absorption efficiency can be improved by creating an air gap between the sound absorber and the wall that receives the sound excitation.

## OBJECTS AND SUMMARY OF THE INVENTION

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The present invention relates to an acoustic panel of the above-specified type of structure that makes that it possible advantageously to create such an air gap.

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The invention thus provides an acoustic panel comprising first and second walls between which a sound absorber is disposed, wherein the first wall presents on an inside face facing towards the sound absorber, a plate of viscoelastic material, and also a backing plate carrying spacer elements (e.g. parallel strips, honeycomb, embossing, and/or studs) that are distributed in at least one dimension and that create an air gap between the absorber and the backing plate.

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More particularly, the spacer element may form a two-dimensional array, e.g. in the form of a grid or a honeycomb or embossing, or indeed in the form of studs distributed in said two dimensions.

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The grid, the honeycomb, or the embossing may constitute a net or bag having the sound absorber placed therein. In particular, the net or bag may be made of a thermally conductive material so as to constitute a heat sink between said walls.

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A self-adhesive film carrying said array (e.g. grid, honeycomb, embossing, and/or studs) may be stuck onto the sound absorber, in particular onto packaging of the sound absorber, or onto the backing plate.

In a preferred variant, the backing plate is stiffened by embossing, by optionally parallel ribs, by a honeycomb, by studs, or by bosses.

## BRIEF DESCRIPTION OF THE DRAWINGS

Other characteristics and advantages of the invention appear better on reading the following description given by way of non-limiting example and with  
5 reference to the accompanying drawings, in which:

- Figure 1 is an exploded view of an embodiment of the invention; and

- Figures 2 to 6 show variants of the invention.

## MORE DETAILED DESCRIPTION

10 In Figure 1, the acoustic panel presents a first plate 1 which receives sound excitation (arrow F) when the panel is in place, a second wall 2, and a sound absorber 3, e.g. glass wool which may be contained in a fine case 4 made of "Mylar" (trademark filed in the name  
15 of DuPont).

The plate 1 presents on its inside face a plate 17 made of a viscoelastic material (e.g. the material named "Deltane" from the supplier Paulstra).

An air gap is provided by using a mechanical spacer  
20 constituted by a grid or by embossing 5 which may be secured to a rigid backing plate 10, or indeed by a embossed backing plate.

The mesh shape may be arbitrary, however its size must be such that under the action of the pressure to  
25 which the absorber is subjected, the absorber does not move beyond the area defined by the mesh, i.e. it does not come into contact with the backing plate 10, and the air gap maintains the desired thickness.

The nature of the material constituting the grid is  
30 selected as a function of environmental constraints for the intended application. The material may be malleable so as to allow the grid to be fitted to shapes that are complicated, providing that during deformation and under the pressures involved during assembly or use the  
35 absorber 3 cannot come into contact with the backing plate 10.

The grid 5 as defined may be stuck onto the inside face of the backing plate 10, taking care to ensure that the adhesive does not fill the mesh of the grid so as to avoid any contact with the sound absorber.

5       The absorber 3 is of low-density glass wool contained in a fine "Mylar" (registered trademark) case. The spacer may be a grid of stainless steel wire having a diameter of 0.5 millimeters (mm) with a square mesh having a side of 10 mm. The reduction in transparency is  
10       of the order of 3 decibels (dB) to 4 dB.

      The grid 5, e.g. a square grid (Figure 2), may be replaced by a honeycomb 6 (Figure 3) of suitable size. Too small a mesh would lead to a large connection area between the backing plate 10 and the absorber 3, thereby  
15       reducing performance.

      The grid could be replaced by studs 8 (Figure 4) regularly distributed over the inside surface 11 of the backing plate 10. This can be done by using a self-adhesive film 9 carrying the studs 8 and stuck to the  
20       surface 11. Alternatively, the film 9 may equally well be stuck to the absorber 3 or to its packaging 4, as is applicable to certain kinds of glass wool.

      Nevertheless, care should be taken to ensure that the absorber is not flattened since that would facilitate  
25       contact between the absorber and the backing plate 10 and thus would contribute to undesired coupling with the wall 1 that receives the excitation.

      The grid 5 may constitute a net 7 in which the absorber 3 is placed.

30       In a variant implementation of the invention, the plate 1 presents on its inside face a plate 17 of viscoelastic material (e.g. the material "Deltane" from the supplier Paulstra), and a backing plate 10 which is embossed so as to stiffen it and which serves to damp the  
35       vibration of the plate 1 that is subjected to the excitation. This configuration enables the backing plate 10 to be lighter in weight (and possibly also the plate

17) by reducing its thickness while maintaining its stiffness by means of walls 18 extending perpendicularly to its surface. These walls act as a spacer to prevent the absorber coming into contact with the backing plate (Figure 9).

In the embodiments of Figures 5 to 7, the backing plate 10 may be constituted by an adhesive plate 10 carrying strips 18 in one or two dimensions.

In Figure 6, the spacers 18 are ribs of the backing plate 10 arranged in a single dimension and spaced apart from one another, generally at a constant pitch.

In Figure 7, the ribs 18 (distributed in one or two dimensions) on the backing plate 10 are wide enough to allow the plate 17 of viscoelastic material to occupy the hollow portion 19 thereof (see in particular the detail of Figure 7).

#### Example 1

A wall 1 of 1.2 mm thick aluminum was damped firstly by a sheet 17 of 1 mm thick viscoelastic material and secondly by a plane 0.5 mm thick backing plate 10 of aluminum.

#### Example 2

A wall 1 of 1.2 mm thick aluminum was damped firstly by a 0.5 mm sheet 17 of viscoelastic material and secondly by a 0.3 mm thick backing plate 10 of aluminum embossed with a square mesh having a side of 10 mm and a rib height of 2 mm (cf. Figure 6).

For excitation of 0.1 g applied to a 1.2 mm thick plate 1 of aluminum having dimensions of 210 mm × 230 mm, Figure 8 shows vertical acceleration level in meters per second per second ( $m/s^2$ ) as a function of frequency F (in the range 0 to 3000 hertz (Hz)), for the following circumstances:

curve I: said plate 1 alone;

curve II: said plate 1 damped by a 1 mm thick sheet 17 of viscoelastic material ("Deltane") and a 0.5 mm thick backing plate 10 of aluminum; and

5 curve III: said plate 1 damped by a 0.5 mm thick sheet 17 of viscoelastic material ("Deltane") covered in its center by a 0.3 mm thick backing plate 10 of aluminum (150 mm x 15 mm) embossed with a square mesh having a side of 10 mm and a rib height of 2 mm.

10 It can be seen that the vibration peaks (curve I) are well damped in both circumstances (curves II and III). For comparable or better performance, stiffening the backing plate 10 makes it possible to reduce the thickness both of the viscoelastic sheet 17 and of the backing plate 10, thereby achieving a significant saving  
15 in weight.